# *Center for Integrated Nanotechnologies (CINT): Overview*

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**Motivation—**The Center for Integrated Nanotechnologies (CINT) is a Department of Energy/Office of Science Nanoscale Science Research Center (NSRC) operating as a national user facility devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials.

CINT is one of five NSRCs throughout the U.S. that form an integrated national program, affiliated with major facilities at the DOE's National Laboratories, to cover the diverse aspects of nanoscience and technology. This complex aspires to become a cornerstone of the nation's nanotechnology revolution, contributing to DOE's principal missions in national defense, energy, and the environment while providing an invaluable resource for universities and industries.

Through its Core Facility in Albuquerque with gateways to both Los Alamos and Sandia National Laboratories, CINT provides open access to tools and expertise needed to explore the continuum from scientific discovery to the integration of nanostructures into the micro- and macro world. This pathway involves the experimental and theoretical exploration of behavior, the development of a wide variety of synthesis and processing approaches, and an understanding of new performance regimes testing design and integration of nanoscale materials and structures. Integration itself is key to the exploitation of nanomaterials, and the scientific challenges that it poses are at the heart of CINT's mission.

Now in its first year of full operations, CINT is hosting users from more than 30 states and 10 foreign countries. Recent progress is detailed in following Briefs which give a sense of the breadth of ongoing work in CINT.

**Accomplishment—**Mike Lilly, John Reno, and co-workers are exploring the interactions of electrons and holes in closely spaced electron and hole two-dimensional sheets. These experiments are possible only due to the extraordinarily high quality GaAs/AlGaAs material grown in CINT.

Normand Modine and collaborators from the University of Michigan have developed theoretical understanding of the observed multiple surface reconstructions in compound semiconductor alloys. Their results demonstrate the influence of both atomic size mismatch and lattice mismatch strains on the resulting reconstructions.

Brian Swartzentruber has developed a nanomanipulator that can measure properties of as-grown nanostructures, as well as manipulate nanostructures to control their placement and build more complex configurations.

Gary Kellogg is using the low energy electron microscope available in CINT to study how chemical heterogeneity develops at surfaces. This work may shed light on approaches to mitigating the effect of electromigration on Cu interconnects in microelectronics.

Dale Huber is working with scientists at a local company in Albuquerque to develop magnetic nanoparticles that could be used in new diagnostic techniques for detecting disease.

Additional information on CINT is available at http://cint.lanl.gov/

**Sponsors for various phases of this work include**: DOE Office of Basic Energy Sciences/Center for Integrated Nanotechnologies (CINT)

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**Figure 1**. The 96,000 $ft^2$ CINT Core Facility features state-of-the-art facilities for the synthesis, characterization, and integration of nanoscale materials and structures.


**Figure 2.** The CINT Core Facility capabilities include (clockwise from upper left): chemical synthesis; class 1000 cleanroom, molecular beam epitaxy growth of compound semiconductors; and transmission electron microscopy.